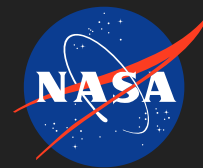# Sample Handling System for in-situ Powder X-ray Diffraction Instruments., Phase I

Completed Technology Project (2004 - 2004)

Project Introduction

The proposed innovation is a Powder Handling System (PHS) that will deliver powdered samples to in situ planetary XRD instruments and provide unique means of analysis optimization through real-time control of the sample characteristics: internal motion for improved statistics, continuous flow of material, controlled thickness, insertion of calibration standard, etc. The major improvements over conventional sample handling are the simplicity of the system and the potential to characterize larger grain-size material, resulting in a significant relaxation of the constraints on sample preparation (grinding). Proof-of-concept prototypes tested in a CheMin XRD/XRF instrument have shown a dramatic enhancement of the quality of the XRD data, even with samples that would normally be impossible to analyze. The PHS will require few or no moving parts and will be robust, lightweight, and compact enough to be imbedded in the host instrument. While developed primarily for XRD applications, the proposed technology could serve a large variety of in situ instruments that require powdered materials. This innovation is a key enabling technology for in situ XRD surface and subsurface mineralogy characterization and directly addresses NASA needs for defined Mars and Venus missions.

Anticipated Benefits

Commercial potential exists in powder-XRD applications where sample handling is critical. Examples are: 1- Industrial analysis of material streams for process monitoring (pharmaceutical, cement, mining, etc.), 2- Laboratory analyses when extended grinding is impossible (unstable or hazardous substances), when samples are extremely small (forensic analysis) or when a controlled environment is necessary, 3- Field analysis of geological materials, soils, drugs, potentially hazardous substances, etc. with an integrated XRD system. This technology could be configured for existing XRD instruments or in a complete system that takes full advantage of the new capabilities. The proposed technology will support NASA applications for landed missions that include in situ instruments requiring powdered material. It is particularly suited to the CheMin XRD/XRF instrument, which was listed in the straw-man payload for Mars Science Laboratory (2009). CheMin will be proposed for MLS as a mineralogical instrument. As the goals of this SBIR Proposal are achieved, the innovation will become a CheMin sub-component. CheMin is also a central instrument of the SAGE Venus Discovery mission concept using aspects of the proposed innovation. New NASA potentials will arise as the technology is further developed and advertised.

Sample Handling System for in-situ Powder X-ray Diffraction Instruments., Phase I

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Organizational Responsibility

Responsible Mission Directorate:

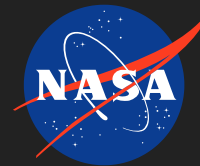Space Technology Mission Directorate (STMD)

Lead Center / Facility:
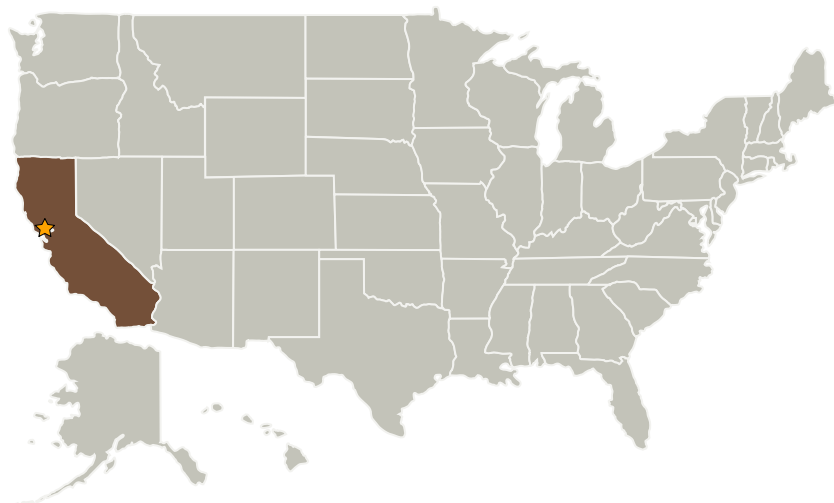
Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
⭐Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Bryson Consulting	Supporting Organization	Industry	Morgan Hill, California

Primary U.S. Work Locations
California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

David F Blake

Principal Investigator:

Philippe C Sarrazin

Technology Areas

Primary:

- TX04 Robotic Systems
  └ TX04.3 Manipulation
    └ TX04.3.4 Sample Acquisition and Handling